

Final Report for NASA GSRP: NGT 50955

awarded to: Scott P. Sarlin

University of Colorado, Center for Astrophysics and Space Astronomy

duration: July 1992 through June 1995*faculty advisor:* Webster Cash

The ambitious research plan proposed for under this grant was unfortunately thwarted by an unforeseen launch vehicle failure just prior to achievement. The primary goal for which Scott Sarlin worked under this grant was to design, build and fly a state of the art, high resolution, ultraviolet (UV) spectrograph in order to calibrate the CO to H₂ ratio in molecular clouds. The instrument itself was successfully built and operated (on the ground) by September of 1994. It did achieve the target goal of 30,000 resolution ($\lambda/\Delta\lambda$) through a band pass of nearly 100 Angstroms centered at 1100 Å. It also implemented a novel solution to the holographic grating equations pioneered by Mr. Sarlin, which significantly reduced the optical aberrations in the spectrograph section. This work has led to other implementations of the technique which built on this work; an example would be the current grating design for the Far Ultraviolet Spectroscopic Explorer (FUSE). Scott has published some of this work and has a more complete paper now in preparation. The detector for this instrument was also a new and novel device, about which Scott gave a presentation at the July 1994 SPIE meeting.

The tragic aspect of this program was that the actual flight failed on 15 Dec 1994. A number of problems occurred during the flight, the most damaging of which was the failure of the parachute to deploy during the reentry of the sounding rocket, thereby totally destroying the payload without yielding the expected data. (Note: a copy of a picture of the impact site taken the next morning is attached.) While the flight was a failure, the instrument did operate properly, and so the educational objectives of this program (those related to Scott's training as an instrumental astrophysicist) were achieved.

The following work was accomplished under this grant:

1. Scott's training in space instrumentation,
2. The completion of Scott's educational (course) requirements for his Ph.D.,
3. The development of a new and novel holographic grating design with extensive implications for future spectroscopic work, both in space and on the ground,
4. Development and testing of techniques for high resolution UV spectroscopy, with direct implications for the FUSE satellite program,
5. A new remote sensing technique (developed during one of Scott's classes and published in the Journal of Remote Sensing of the Environment),
6. (unfortunately) a new sounding rocket failure mode,
7. And, of course, approximately 1/2 of Scott's dissertation.

Additionally, other activities were either initiated or nearly completed under this grant. Following the loss of Scott's experiment, he found a new project to work on which would satisfy his Ph.D. requirements. This project involve the use of very high resolution (250,000 $\lambda/\Delta\lambda$) UV data from Dr. Ed Jenkins' IMAPS shuttle experiment. This grant supported the initial phases of the project. Scott will be examining the detailed structure of H₂ in the local interstellar region, with an intent to determine the physical conditions in that region.

Several papers are also in preparation as a result of work on the HiRes instrument. One paper will discuss the instrument in detail and another will examine the results of several

laboratory measurements of the spectra of various gases conducted prior to the launch of the instrument.

Overall, the "yield" on this fellowship was about as high as is possible, given the tragic event of the total loss of Scott's thesis experiment. He has recovered from this experience, and has probably gained some maturity from it (although it certainly would have been better had it never occurred). I believe that Scott has a bright future ahead of him and that this fellowship played no small part in his advancement. He is expected to earn his Ph.D. in August of 1996.



Webster Cash
Professor and Faculty Advisor

February 5, 1996

